College Algebra
Class Notes
Linear Functions 2: Solving Linear Equations Algebraically and Graphically, Applications,
Zeros (section 1.5)

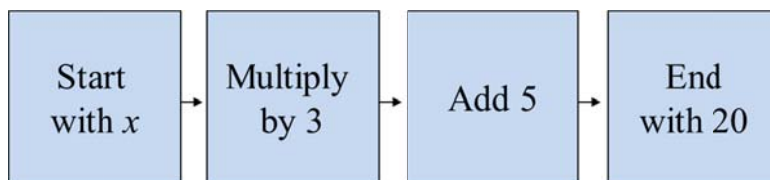**Solving Linear Equations Algebraically**
Solving an equation means to find the value of x that makes the equation true.

When the equation has just one instance of the variable, we can think about undoing what was done to x, to unbury it.

Consider the equation $3x + 5 = 20$. We could solve it by thinking of how it came to be and then reversing or undoing that. Below is the equation's verbal model.

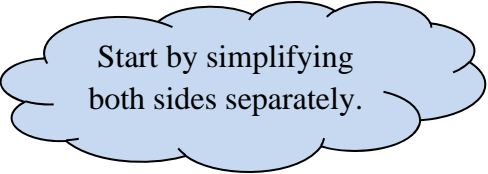| Start with x	Multiply by 3	Add 5	End with 20

Solve $3x + 5 = 20$ below and think about the operations you use. Do you see how these operations *undo* the operations of the verbal model?
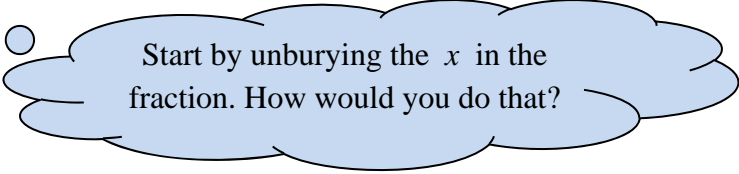
1

Even if there is more than one instance of the variable in the equation, we can still make use of the concept. Remember to manipulate an equation to its most basic form ($x = 5$, for instance), you can add any number, subtract any number, divide by any non-zero number, or multiply by any number on both sides of the equation. We will also use our simplifying skills.
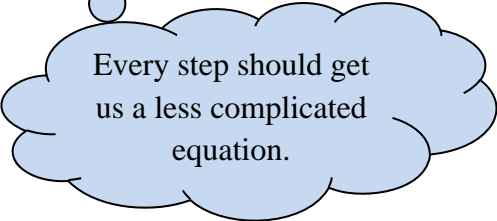
expl 1: Solve $3(x+2)+5 = 4x-3(x+1)$.

Start by simplifying both sides separately.
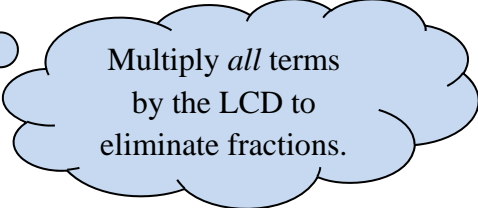
expl 2: Solve $\dfrac{2x+1}{3}+16 = 3x$.

Start by unburying the x in the fraction. How would you do that?

Every step should get us a less complicated equation.

expl 3: Solve $0 = 4x + 10$.

expl 4: Solve $\dfrac{3}{5}x+2 = \dfrac{1}{5}$.

Multiply *all* terms by the LCD to eliminate fractions.
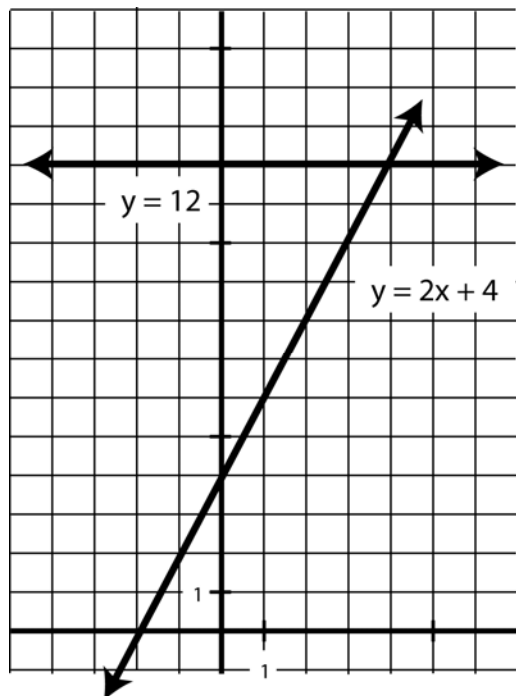
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Definition: Zero:

The x-intercept of a graph is usually written in ordered pair because it is thought of as a point. The **zero** of the relationship is the x-value of this point. Remember this is simply the x-value that makes the y-value equal to 0.

For a function given in $f(x)$ form, like $f(x) = 5x + 9$, how would you find its zero? Do it now.

This idea will follow us throughout algebra.

Solving Linear Equations Graphically

Algebraically, solve the equation $2x + 4 = 12$. Now, take a look at the graphs of $y = 2x + 4$ and $y = 12$ shown below. Where in the graph do you see your solution? Why?

$y = 12$

$y = 2x + 4$

Recognizing our solution in the graph gives us a way to check or outright solve equations graphically. How would you describe the method?

3

Applications: Simple Interest

expl 5: Margie has taken out two simple interest loans for a total of $4500. One has an interest rate of 5% and the other has an interest rate of 8%. If she pays $315 in interest for a single year, how much was each loan for?

Interest from loan 1	$+$	Interest from loan 2	$=$	Total Interest

Does this verbal model ring true?

Simple interest:
I = PRT

Application: Geometry

expl 6: A triangle labeled ABC is drawn so that angle B is three times the measure of angle A. Also, angle C is ten less degrees than twice the measure of angle A. Find the measures of each angle. Round to two decimal places.

Let x represent the measure of angle A. Why?
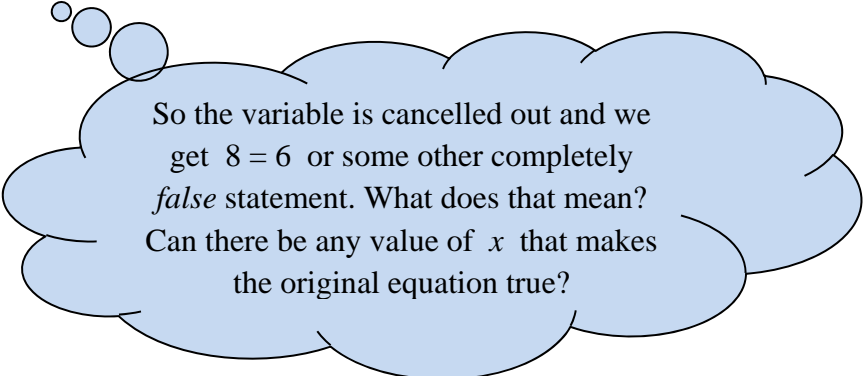
Draw a generic triangle.

What fact about triangles should we use?

No Solutions and Infinite Solutions:

Sometimes equations will go a little goofy when you try to solve them algebraically. What does it mean? Try these two problems.
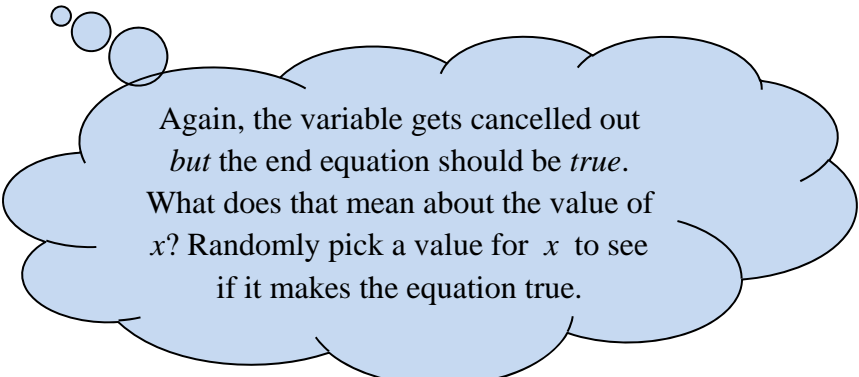
expl 7: Solve.
$3x + 8 = 3(x + 2)$

So the variable is cancelled out and we get $8 = 6$ or some other completely *false* statement. What does that mean? Can there be any value of x that makes the original equation true?

expl 8: Solve.
$x + 7 + x - 3 = 2(x + 2)$

Again, the variable gets cancelled out *but* the end equation should be *true*. What does that mean about the value of x? Randomly pick a value for x to see if it makes the equation true.

Optional Worksheet: Solving Linear Equations:
This worksheet covers the "verbal model" method for solving linear equations which need two or three steps to solve. We think about "undoing" what was done to the variable to unbury it. Solutions are available online.

Optional Worksheet: Story Problem Pieces:
This worksheet practices setting up equations for popular story problems. Solutions are available online.